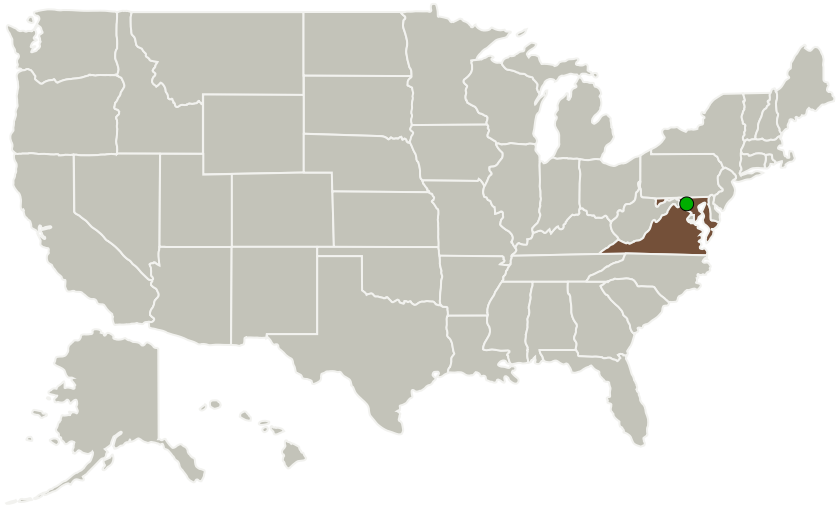
640 GHz Heterodyne Polarimeter, Phase II

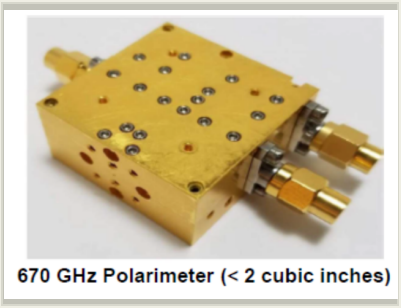
Completed Technology Project (2017 - 2020)

Project Introduction

This proposal is responsive to NASA SBIR Subtopic S1.02: Microwave Technologies for Remote Sensing, specifically the interest in the development of a 640 GHz Heterodyne Polarimeter with I, Q, U Channels. Suitably compact, light-weight and power efficient heterodyne instruments are required to enable polarimetric measurements for microphysical parameterization of ice clouds applicable to NASA's planned Aerosol, Cloud and Ecosystems (ACE) mission. Through the Phase 1 effort, VDI demonstrated the feasibility of an integrated 640 GHz polarimetric receiver. This included the demonstration of a 670 GHz LNA module and an OMT, each being compatible with full integration with the mixer diode based down-convertor. Goals of the Phase II include optimization of the OMT, development and evaluation of a fully integrated 670 GHz polarimeter, development of evaluation procedures to ensure the polarimeter meets NASA requirements, and development of a second prototype at 325 GHz to demonstrate the scaling of the technology. The estimated specifications of the 670 GHz prototype include receiver noise temperature ~6,000K (SSB at the horn aperture), power requirement 6W, volume ~1.5— x 1.5— x 0.75—. The goal isolation between polarizations is 20 — 25 dB. Both integrated polarimeters will be delivered to NASA GSFC. Through Phase III, VDI will ensure that the technology is extended throughout the frequency range of interest for NASA's atmospheric missions, roughly 100 GHz through about 1 THz.

Primary U.S. Work Locations and Key Partners





670 GHz Polarimeter (< 2 cubic inches)

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Table of Contents

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Organizations Performing Work	Role	Type	Location
Virginia Diodes, Inc.	Lead Organization	Industry	Charlottesville, Virginia
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	Virginia

Project Transitions

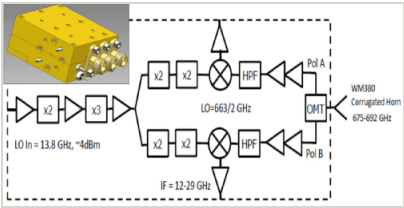
April 2017: Project Start

January 2020: Closed out

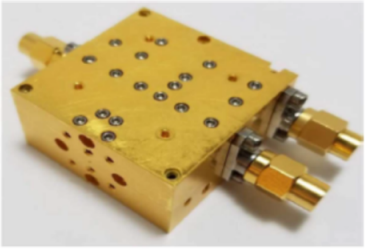
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140823)*

Images



Briefing Chart Image
640 GHz Heterodyne Polarimeter, Phase II Briefing Chart Image *(https://techport.nasa.gov/image/126258)*



Final Summary Chart Image
640 GHz Heterodyne Polarimeter, Phase II
(https://techport.nasa.gov/image/132156)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Virginia Diodes, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

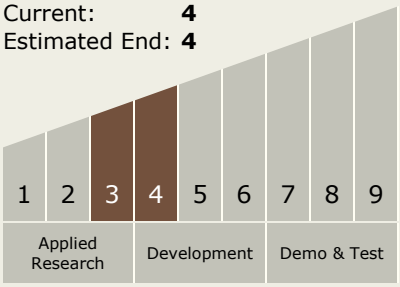
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Jeffrey L Hesler

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System